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ABSTRACT

A study assessed the competencies developed for the Teaching of Elementary Science course by observing recent graduates of the college as they taught science and by interviewing them concerning their science teaching. An instrument was developed for rating teacher behavior in each competency area. Observations were made by college and school district representatives. Two competency areas rated well below the others: (1) the utilization of secondary sources in teaching; and (2) the ability to select and plan activities of instruction that reflect the needs of the students, the developmental level of the students, the developmental level of the concept, and the materials and equipment available. Fifty percent of the graduates contacted did not wish to participate because of their lack of confidence in their science program or lack of science program, and their fear of being observed. (Author/DS)

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Performance Assessment of Elementary School Science Teachers

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Abstract

This study was designed to gather data concerning performance in teaching science of recent elementary education graduates of Shippensburg State College (PA). Ten competency statements were used as the focus for assessment. Data analysis provided evidence that graduates were generally capable in the ten targeted areas. Two competency areas were identified as receiving lower rankings than others. The undergraduate science program will be reviewed with the idea of strengthening competencies in these two areas. The most disturbing component of the study was the lack of cooperation of recent graduates. Almost fifty percent of those contacted did not participate. The reasons given for non-participation should prove alarming for science educators.

Introduction

Science and technology are rapidly changing. Children in the elementary schools today will graduate into a world of work which is considerably different than we know now. It is essential that science education be taught in a manner which prepares the learner for the unknown changes that are to come.

Those who hold that science is not essential, that science is not one of the basics in education, are ignoring the science and technological revolution that is currently surrounding us. They may be frightened of the impact of this change. As science educators we need to insure that science teaching does not succumb to budget cuts or a "back-to-basics" movement. Science cannot be relegated to the "frill" category.

Problem and Rationale

This study was designed to gather data that might help Shippensburg State College strengthen its science education program and therefore, hopefully, promote and strengthen the teaching of science in schools within its service area. This research project sprang from a desire to find out if the science teacher education program now in use was effective in preparing teachers.

In 1974 the Pennsylvania Department of Education issued a mandate for all teacher education programs to become competency based. In 1976 the Elementary Education Department at SSC adopted

generic competencies for its program and science competencies were prepared for the methods course. These competencies became the guidelines for the science methods curriculum.

In 1979 it was decided that a follow-up study of students who had completed the program could provide information on the success of this science teacher preparation component in terms of stated competencies. As in most other schools, some small changes are occuring in classes from semester to semester, but no formal assessment of the effects of these changes had been completed. It was decided that before any major revision of the science methods course would or could be accomplished, that the effectiveness of what was currently being done should be determined.

Procedures

The procedures for the study were as follows. First, an assessment instrument was developed which reflected the science education program competencies. The initial list of competencies developed in 1976 was abridged. Ten competencies which were considered essential and observable in a classroom setting were used as the focus for the study. These competencies were: (1) selecting and planning of activities for instruction, (2) choosing the appropriate method of instruction, (3) questioning ability, (4) adjusting instructional materials, (5) creating effective induction sets, (6) arranging equipment and seating to promote instruction, (7)

understanding and using of the process skills, (8) using scientific attitudes to promote learning, (9) utilizing of secondary sources in teaching, and (10) communicating with students and peers.

During the early months of the Fall semester of 1979-80 the instrument was field tested and revised. During this time period, liason with district superintendents was also started in order to identify recent (last 5 years) graduates of SSC. Fifty-five former students were identified in eleven school districts. These teachers were contacted for permission to observe them while they were teaching science. Six teachers were observed in the pilot phase of the program and twenty-four in the final assessment phase.

The school districts also identified those persons from the districts who would be doing the assessment for the districts using the same instrument, and a short training session was given to each person.

After a pilot study in the fall, classroom observations were begun in the second semester of academic year 1979-80.

In this study it was assumed that the College did prepare teachers to teach, i.e., educated them in the skills and knowledge of a given academic area such as science. But, whether or not teachers used those skills was largely dependent on their personal traits and the encouragement they received from their district administration and peers.

It was acknowledged that many teachers who were observed might have created the science unit just for the study. They may have been open to recognition from the College that was missing in their schools. The study only focused on whether they had the identified competencies, not whether the teachers taught science each day, each week, or only occasionally.

During the development of the instrument it was decided that a manual would be of great assistance in communicating the purposes, details, and guidelines for the study. The manual was also a physical link between the project staff and the school districts.

The manual contained the original twenty-one competencies for the science method course followed by the rationale for abridging those original competencies. It also contained instructions for teachers being observed, procedures for observers to follow, and the assessment scale with directions for its use.

The ratings done by the College staff and the school districts were collected and coded. There were three ratings completed for each of the teachers--two by College personnel and one by the district representative. These ratings were analyzed across competency statements (ten) for each teacher observed (twenty-four). The means of ratings are shown in Table 1.

Insert Table 1 about here

Ratings were examined to determine the coefficient of correlation between raters. Table 2 lists the correlation coefficients for the pairings examined.

Insert Table 2 about here

The ratings done by district personnel varied widely from that done by College faculty and staff. Even though overall mean ratings were similar, this data caused the researchers some concern.

The competency items ratings varied from 4.31 (high) to 2.75 (low) from the averaged data. The highest rating possible was 5.00. Table 3 shows the competency items in order of their ratings.

Insert Table 3 about here

Competencies ranked above 4.00 were considered to have been well developed in the preparation of the teachers. For these items, teachers repeatedly performed well in their classrooms as they taught their science lessons. Items four and six had an average ranking above 4.00 by all observers across twenty-four observations. The undergraduate science teacher education program was considered to have prepared teachers well in the areas of competencies four, six, and ten.

Competency statements two, three, eight, seven, and five were ranked at 3.25 or higher. Teachers, while displaying a lesser performance rating on these items than the set just described, nonetheless were considered to be performing at an adequate level.

This high performance level on eight of the ten competencies was interpreted to mean that teachers were adequately prepared in these performance areas.

The two competency statements that received the lowest ranking--below 3.00--were numbers one and nine. While these items ranked above a 2.50 which could be considered an average rating, they were determined to be the areas where the science staff should begin in course revision. A primary function of classroom teachers is the planning of activities for instruction. While faculty believed that instruction in this area was not weak, an examination of the curricula influencing this competency, both written and taught, is planned. Other measures of competencies one and nine are planned to give the faculty a broader data base for decision making. Examination of methods to enhance learning in the performance area of competency nine is to be undertaken in this next academic year.

Conclusions and Implications

During the course of this study the single most disturbing factor was the apparent lack of cooperation from former students.

When designing the program for assessment, the researchers felt confident that since each student was known personally, acceptance to be observed would be perfunctory. The fact that nearly fifty percent of those students (now teachers) contacted refused to cooperate has been the focus of many hours of discussion.

A formal/informal survey of the reasons for not cooperating was illicited and the following list was produced:

1. Do not teach science
2. Personal schedule too busy
3. Too much work
4. Feel their science program is inadequate
5. Feel their science teaching is inadequate
6. Did not want to be observed by the administration

In Georgia, where performance assessment has been done on teachers also (Okey and Capie, 1979), the power of state policy seems to eliminate the problem of cooperation--it is mandated.

Cooperation with district administration was greatly enhanced during this study. The fear of observation among teachers was evident to district observers as well as the SSC team. It was apparent that the teaching of science in elementary schools is perceived by many teachers to be a secondary subject goal at best. Where science is taught, it is generally taught well. However, whether from district or societal applied pressures and policies, science apparently is perceived as less necessary than

art, music, or spelling.

The implications for SSC faculty in science education are clear: either help to create a more positive feeling about the need for teaching science in the elementary schools among teachers and teachers-to-be, or work to alter the policies and pressures applied by society and administrations. Obviously, science educators need to consider both lines of attack on this national problem.

Many reasons can be considered for the low ratings on items one and nine. Itme one states: the ability to select and plan activities of instruction that reflect (a) the needs of the students, (b) the developmental level of the students, (c) the developmental level of the concept or conceptual scheme, (d) the materials and equipment available. Item nine is the ability to utilize secondary sources in the development of teaching units. Both items fall into the common area of preparations made by the teacher. Such preparations take time and resources. Perhaps teachers do so much planning and preparation in other areas, perceived as more important, that there is little time for doing it in science. Perhaps they do not know how to do these things efficiently in the areas of science. Or, perhaps, science is just not worth the effort for them.

There was general feeling among the researchers and school observers that the instrument was "on target". Teachers who were part of the study indicated no apprehensions concerning the

instrument.

Because the population sample was small, the data could be biased. However, due to the voluntary nature of participation, if such a bias existed, one would have to assume that it would be favorable to science. Also, because observation dates were pre-arranged, time for preparation and "being ready" would appear to be favorable to science and lead to inflated ratings on these two items, as well as others.

In the past, considerable emphasis has been placed on selecting and planning science activities. The mode of this presentation needs to be re-examined.

The task of preparing children who are scientifically literate and who maintain their early scientific attitudes, such as curiousity and honesty, is growing more important each moment. These same goals need to guide science educators.

Reference Note

1. Okey, James R., & Capie, William. Assessing the Teaching Competence of Science Teachers. Paper presented at the annual meeting of the National Association for Research in Science Teaching, Atlanta, March 1979.

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Okey, James R., & Capie, William. Assessing the Teaching Competence of Science Teachers. Paper presented at the annual meeting of the National Association for Research in Science Teaching, Atlanta, March 1979. (Department of Science Education, University of Georgia, Athens, Georgia.)

Table 1

Means of Ratings on Competency

Statements from PAESST

	R_1	R_2	R_3	Average
1	2.75	2.67	3.46	2.96
2	3.71	3.42	3.79	3.64
3	3.54	3.92	3.71	3.51
4	4.54	4.38	4.00	4.31
5	3.21	2.75	3.79	3.25
6	4.29	4.04	4.33	4.22
7	3.33	2.92	3.67	3.30
8	3.29	3.17	3.87	3.44
9	2.67	2.92	2.67	2.75
10	4.08	3.71	4.21	4.00
$\bar{X}$	3.54	3.33	3.75	

R_1 - Ratings by professorial staff

R_2 - Ratings by research assistant

R_3 - Ratings by school district personnel

(Rating scale was from 1 - 5)

Table 2

Correlation Coefficients of

Paired Rating

	R_1	R_2	R_3
R_1	1.000	0.7917	0.5725
		P = 0.000	P = 0.002
R_2	0.7917	1.000	0.3957
	P = 0.000		P = 0.028
R_3	0.5725	0.3957	1.000
	P = 0.002	P = 0.028	

N = 24

R_1 - Ratings by professorial staff

R_2 - Ratings by research assistant

R_3 - Ratings by school district personnel

Table 3

Competency Statement

Listed by Order of Ranking

Order	Competency	Average Ranking
1	4	4.31
2	6	4.22
3	10	4.00
4	2	3.64
5	3	3.51
6	8	3.44
7	7	3.31
8	5	3.25
9	1	2.96
10	9	2.75